

### **REMARKS**

Claim 63 is amended and claims 90-103 have been added. The new claims are supported by exemplary embodiments of Applicant's invention at, for example, pgs. 12-13 or the originally-filed application. Claims 1, 4-14, 56-103 remain in the application. Reconsideration of the application in view of the amendments and the remarks to follow is requested.

The specification is amended to recite exemplary openings 130 and 131 comprise trenches. This language is supported by Fig. 9 of the originally-filed application.

Claim 78 stands rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification. During an interview with Examiner Pizzaro-Crespo on February 26, 2004, agreement was reached that this is an improper rejection. Claim 78 recites a first electrode layer comprises a monolithic unitary material. However, the Examiner incorrectly referred to claim 78 as reciting a conductive region and addressed this language in his rejection. Applicant's representative pointed out this was a limitation not recited by claim 78, and therefore, the rejection was not relevant. The Examiner agreed, and therefore, Applicant requests withdrawal of this rejection in the next office action.

Claim 80 stands rejected under the first, second and fourth paragraphs of 35 U.S.C. §112, all based on the same rationale. Claim 80 recites a high K

substantially crystalline material layer is less than 80% crystalline. For each rejection, the Examiner alleges that such recitation leaves the percentage range open-ended, that is, lacking a lower limit of the percentage range. During an interview with Examiner Pizzaro-Crespo on February 26, 2004, agreement was reached that this is an improper rejection because independent claim 1 (from which claim 80 depends) provides the lower limit of the percentage range. Claim 1 recites a high K substantially crystalline material layer is at least 70%). The Examiner agreed, and therefore, Applicant requests withdrawal of the three §112 rejections against claim 80 in the next office action.

Regarding the §112, first paragraph, rejection against claim 71, such claim recites an opening comprises a trench. The Examiner was unable to obtain Applicant's figures during the interview. However, he stated that the originally-filed application does not describe the opening as a trench. During the Examiner Interview of February 26, 2004, the Examiner and Applicant's representative discussed and reviewed the reference, Silicon Processing for the LSI Era, by S. Wolf, vol. 2, pgs. 600-609 which illustrates exemplary openings referred to as trenches. Applicant's representative stated that the openings of Wolf are similarly configured as shown by Fig. 9 of Applicant's originally-filed application, and therefore, at least this Fig. 9 provides support for a trench. While no agreement was reached, the Examiner stated he would reconsider this rejection once he was able to review Applicant's Figures.

The Examiner is respectfully reminded that regarding the rejection based on §112, first paragraph, MPEP 2163.02 (8<sup>th</sup> Ed.) states the test for sufficiency of support in an application is whether the disclosure relied upon reasonably conveys to the artisan that the inventor had possession at that time of the later claimed subject matter. MPEP 2163.01 (8<sup>th</sup> Ed. *citing* Ralston Purina Co. vs. Far-Mar-Co., Inc., 772 F.2d. 1570, 1575, 227 USPQ 177, 179 (Fed. Cir. 1985) (emphasis added). Notably, “[t]he subject matter of the claim need not be described literally (i.e., using the same terms or *in haec-verba*) in order for the disclosure **to satisfy the description requirement** (MPEP 2163.02 (8<sup>th</sup> Ed.)) (emphasis added). The originally-filed application discusses two exemplary types of capacitors, “cylindrically stacked or trench structures” (pg. 1 of the originally-filed application). Moreover, Fig. 9 of the originally-filed application discloses exemplary capacitor container openings 130 and 131 that are elongated and have corners (see also pgs. 12-13) which are similar to the trenches as taught by Wolf at pgs. 600-609 of volume 2. Therefore, Applicant submits such a disclosure, that is Fig. 9, would reasonably convey to the artisan skilled in the semiconductor arts that Applicant had possession of the subject matter to a [capacitor] opening that comprises a trench, pursuant to the above authority. as recited in claim 71. Consequently, Fig. 9 provides the required support for claim 71, and therefore, no new matter is added for amending the specification. The rejection based on §112 against claim 71 is inappropriate and should be

withdrawn.

Claims 1, 4-11, 13, 14, 56 and 80 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ramakrishnan (5,192,871) in view of Motorola (5,943,580). Claims 57-59 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ramakrishnan and Motorola in view of Narui (6,201,728) and Merchant (6,235,594). Claims 60-62 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ramakrishnan and Motorola in view of Eguchi (5,442,585) and Shrivastava (5,557,122). Claim 81 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Ramakrishnan and Motorola in view of Yanagita (6,376,332). Claims 63-66 and 73-79 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Mihara (5,561,307) in view of Mueller (5,864,496) and Koh (5,920,775). Claims 63, 71-73, 75, 76 and 78 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Schuele (5,760,474) in view of Koh. Claims 64-68 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Schuele and Koh in view of Ramakrishnan. Claims 69 and 70 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Schuele and Koh in view of Motorola. Claim 82 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Schuele and Koh in view of Yanagita. Claim 83 stands rejected under 35 U.S.C. §102(b) as being anticipated by Mihara. Claims 84-86 and 88 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Mihara in view of Motorola. Claims 83, 87 and 89 stand rejected under 35

U.S.C. §103(a) as being unpatentable over Schuele in view of Ramakrishnan.

Independent claims 1 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Ramakrishnan (5,192,871) in view of Motorola (5,943,580). The Examiner correctly states that Ramakrishnan fails to disclose a high K substantially crystalline material layer is at least 70% crystalline and less than 90% crystalline as positively recited in claim 1 (pg. 5 of paper no. 35). The Examiner provides Motorola to supply the deficiency in teachings (page 6 of paper no. 35). The Examiner alleges that Motorola teaches that by selecting the crystallinity percentage of dielectric layers, one is able to create capacitors with a wide range of dielectric constants on a single substrate (page 6 of paper no. 35). In other words, controlling the degree of crystallinity of Ramakrishnan's dielectric layer gives the skilled artisan control over the dielectric constant of the capacitor dielectric (page 6 of paper no. 35). Accordingly, the Examiner next provides a motivational rationale stating that it would be an obvious matter of design choice of one of ordinary in the art to select the degree of crystallinity of Ramakrishnan's dielectric layer since this is a variable of importance subject to routine experimentation and optimization as taught by Motorola (page 6 of paper no. 35). That is, the Examiner is stating that one skilled in the art with the teachings of Ramakrishnan and Motorola in front of him would modify the Ramakrishnan dielectric layer to have a high K substantially crystalline material layer at least 70% crystalline and less than 90% crystalline as positively recited

in claim 1. The Examiner is mistaken.

One skilled in the art would not modify the crystalline percentage of the crystalline layer of the Ramakrishnan device. Ramakrishnan clearly discloses at line 35+ of col. 2 that dielectric layer 16 must be formed so as to have the **highest possible dielectric constant** and **crystalline films have higher dielectric constants than amorphous or partially crystalline films**. As set forth in col. 4, lines 20+, it is stated that the amorphous film should be **as thin as possible in order to prevent degradation of capacitor performance since the dielectric constant of amorphous film is less than that of crystalline film**.

However, Motorola is concerned with varying the amount of crystallinity to vary the dielectric constant. The teachings in col. 3 of Motorola relied upon by the Office Action in support of the rejection state that an amorphous layer may be selectively annealed to be partially crystalline **with the remaining portion remaining amorphous**.

In view of the above, there is no motivation to combine the inapposite reference teachings of Motorola with the teachings of Ramakrishnan and in fact Ramakrishnan clearly teaches away from such a combination. More specifically, Motorola teaches converting amorphous material to crystalline material and unconverted portions remain amorphous which clearly degrades dielectric constant of the material. Ramakrishnan teaches providing the **highest possible dielectric**

**constant** and the amorphous film should be **as thin as possible**. To modify the teachings of Ramakrishnan according to Motorola would yield amorphous material greatly reducing the dielectric constant and which is directly contrary to Ramakrishnan providing the **highest possible dielectric constant** and the amorphous film should be **as thin as possible**. Further, Ramakrishnan already discloses provision of the separate thin amorphous layer and Ramakrishnan clearly teaches away from providing additional amorphous material by converting the crystalline material to amorphous material which is the result if Ramakrishnan were modified as set forth in the office action.

At least in view of the above, ***but for improper reliance upon Applicant's disclosure, there is absolutely no motivation to modify Ramakrishnan according to Motorola and the modification is in direct contradiction to the explicit Ramakrishnan teachings***. The teaching away of Ramakrishnan demonstrates the improper combination of the reference teachings. There is no motivation and the 103 rejection is improper for at least this reason.

Ramakrishnan tacitly teaches to form the dielectric layer in complete crystalline form, 100% crystalline, **not amorphous or partially crystalline**, and therefore, Ramakrishnan teaches away from having the **high K substantially crystalline material layer is at least 70% crystalline and less than 90% crystalline** as claimed. Teaching away is considered the antitheses of the art suggesting that a person of ordinary skill would go in the claimed direction. Essentially,

teaching away from the art is a *per se* lack of obviousness. *In re Dow Chemical Co.*, 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir. 1988). Accordingly, with the tacit teachings of Ramakrishnan to not form a partially formed crystalline film, one skilled in the art would not look to Motorola to do just the opposite, that is, to modify the Ramakrishnan invention to have a high K substantially crystalline material layer of at least 70% crystalline and less than 90% crystalline as positively recited in claim 1. Pursuant to the above authority, since Ramakrishnan teaches away from going in the direction suggested by the teachings of Motorola, the combination of art presented by the Examiner is *per se* lack of obviousness. Consequently, the obviousness rejection against claim 1 fails, and therefore, claim 1 is allowable.

Moreover, since Ramakrishnan teaches away from having a partially formed crystalline film, all the Examiner's rationales for relying on Motorola to modify the Ramakrishnan invention must necessarily fail. That is, one skilled in the art **would not be motivated** to "controlling the degree of crystallinity of Ramakrishnan's dielectric layer" (pg. 22 of paper no. 35) as alleged by the Examiner, because Ramakrishnan teaches away from having a partially formed crystalline film or providing an increased amount of amorphous material at the expense of crystalline material. Additionally, based on Ramakrishnan's teaching away, it is inconceivable that an appropriate statement could be made that "it would be an obvious matter of design choice of one of ordinary in the art...to

select the degree of crystallinity of Ramakrishnan's dielectric layer since this is a variable of importance subject to routine experimentation and optimization." Ramakrishnan clearly teaches just the opposite, that the degree of crystallinity **is not to be a variable** subject because the dielectric layer is to have the highest possible dielectric constant which means having a complete crystalline film without degrees of crystalline. Consequently, it could not reasonably be stated to be a "design choice" to modify the Ramakrishnan crystalline layer to be at least 70% crystalline and less than 90% crystalline as positively recited in claim 1. Since all the Examiner's rationales for modifying the Ramakrishnan invention are contrary to the teaching of Ramakrishnan, such rationales do not exist and cannot support an obviousness rejection. Claim 1 is allowable.

Furthermore, modifying the Ramakrishnan device by teachings of Motorola is redundant on at least two levels. Motorola teaches to vary the crystallinity percentage of an amorphous layer to vary the **dielectric constant**. Motorola is devoid of teachings to leakage current. Ramakrishnan teaches how to address leakage current problems associated with completely crystalline high K layers by providing an amorphous layer adjacent the completely crystalline high K layer. One skilled in the art with the concerns of Ramakrishnan would not look to Motorola for any meaningful teachings which Motorola does not provide, that is, teachings to resolve leakage current problems. In fact, since Ramakrishnan already solves leakage current problems, one skilled in the art with the concerns

of Ramakrishnan would not look to Motorola to solve a problem Ramakrishnan has already resolved, this is redundant. Moreover, one skilled in the art would not look to Motorola for teachings to modify the crystalline percentage of the Ramakrishnan crystalline layer by providing an increased amount of amorphous material pursuant to Motorola since Ramakrishnan already teaches providing an amorphous layer adjacent the completely crystalline layer and Ramakrishnan stresses the importance of leaving the highest possible dielectric constant. This would be redundant because any benefit gained by modifying the crystalline layer of Ramakrishnan to have a percentage of amorphous material is already gained by the amorphous layer taught by Ramakrishnan. Since modifying the Ramakrishnan device with teachings of Motorola is contrary to Ramakrishnan and is redundant, on several levels, one skilled in the art would not be motivated to make the modification. Without the motivation to make the modification, the 103 rejection is improper.

Additionally, the Examiner is respectfully reminded that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. MPEP §2143.01 (8th Edition) *citing to In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). To modify the Ramakrishnan crystalline layer to be at least 70% crystalline and less than 90% crystalline as positively recited in claim 1 would render the Ramakrishnan invention

unsatisfactory for its intended purpose, that is, the purpose to have a dielectric layer with the highest possible dielectric constant. Pursuant to the above authority, since the modification of the Ramakrishnan invention by the teachings of Motorola would render the Ramakrishnan invention unsatisfactory for its intended purpose, there is no suggestion or motivation to make the proposed modification. Without proper motivation, the obviousness rejection is improper and must be withdrawn. Claim 1 is allowable.

Additionally, the Examiner states that the degree of crystallinity of a dielectric layer is a parameter subject to optimization and not patentable unless unobvious or unexpected results are obtained (pg. 5 of paper no. 35). Initially, Applicant submits there is no "optimization" with respect to degree of crystallinity inasmuch as Ramakrishnan teaches use of the crystalline layer to provide the highest dielectric constant possible. The Examiner is respectfully reminded that he "bears the initial burden of factually supporting any *prima facie* conclusion of obviousness" MPEP §2142 (8<sup>th</sup> ed.). The numerous above-stated arguments demonstrate that the Examiner has failed to provide a *prima facie* conclusion of obviousness. Without the *prima facie* conclusion of obviousness, the Applicant is not required to provide evidence of unobvious or unexpected results. "If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness" MPEP §2142 (8<sup>th</sup> ed.). Based on this authority, since the Examiner has failed to provide a *prima facie*

conclusion of obviousness, the applicant is under no obligation to move forward and submit evidence of nonobviousness, that is, unobvious or unexpected results. Claim 1 is allowable.

Claims 4-14, 56-62, 80-81 and 90-93 depend from independent claim 1, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

For example, claim 60 recites a high K substantially amorphous layer comprising a **thickness in a range** of about 20 Ångstroms to about 250 Ångstroms. The Examiner rejects this claim based upon the combination of Ramakrishnan and Motorola in view of Eguchi and Shrivastava (page 8 of paper no. 35). The Examiner correctly states that Ramakrishnan and Motorola fail to teach specific thicknesses of an amorphous dielectric layer other than Ramakrishnan teaching it should be as thin as possible (page 8 of paper no. 35). To supply the deficiency in teachings, the Examiner relies on the teachings of Shrivastava and Eguchi to allege that capacitor dielectric thickness differences are considered an obvious design choice and therefore it would be an obvious design choice to modify the capacitor dielectric layer of Ramakrishnan as taught by the two references since the capacitor dielectric thicknesses are a variable of importance subject to routine experimentation optimization. However, there is no teaching that **capacitor dielectric** thicknesses has any relevance to thicknesses

of **amorphous layers**. As correctly stated by the Examiner, Shrivastava and Eguchi teach **capacitor dielectric thicknesses**, not thicknesses for **amorphous layers**. Obvious design choices to modify **capacitor dielectric thicknesses** is not a relevant teaching to modifying thicknesses for amorphous layers. One skilled in the art would not look to Shrivastava and Eguchi for teachings of **capacitor dielectric thicknesses** to modify the thickness of the Ramakrishnan **amorphous layer**. Moreover, the Ramakrishnan teaching to the amorphous layer being as thin as possible is contrary to teaching a range of thickness as recited in claim 60. Consequently, the combination of art fails to teach or suggest a high K **substantial amorphous material layer comprises a thickness** in a range of about 20 Ångstroms to about 250 Ångstroms as positively recited in claim 60. Accordingly, the obviousness rejection against claim 60 is improper and should be withdrawn. Claim 60 is allowable.

Claim 63 stands rejected as being unpatentable over Mihara in view of Mueller and Koh. Additionally, claim 63 stands rejected as being unpatentable over Schuele in view of Koh. Independent claim 63 recites an antireflective coating layer comprises an outermost portion of an insulative material. The art of record fails to teach or suggest an antireflective coating layer. Accordingly, it is inconceivable that the art of record teaches or suggests an antireflective coating layer comprises an outermost portion of an insulative material as positively recited in claim 63. Since the art of record fails to teach or suggest

a positively recited limitation of claim 63, claim 63 is allowable.

Moreover, regarding the combination of Mihara in view of Mueller and Koh, the Examiner states that Mihara teaches a high K dielectric layer 96 and a silicon oxide 92 wherein Koh teaches replacing silicon oxide with a high K dielectric to increase performance (pg. 12 of paper no. 35). The Examiner continues that it is obvious to modify the Mihara device to replace the silicon oxide with a high K dielectric to increase performance (pg. 12 of paper no. 35). However, this would provide the Mihara device with two high K dielectrics which is redundant. One skilled in the art with the Mihara device before him would not look to Koh for the same redundant teachings and modify the Mihara invention with that structure it already includes. "Preferably the Examiner's explanation should be such that it provides that impetus necessary to cause one skilled in the art to combine the teachings of the references to make the proposed modification." *Ex Parte Levengood*, 28 USPQ2d, 1300, 1301, Footnote 2, (Bd. Pat. App. and Inter. 1993) (citations omitted). Adding a second high K dielectric needlessly to the Mihara device is redundant, and therefore, there is no motivation to modify the Mihara device with the teaching of Koh. Since the motivational rationale for combining Mihara in view of Mueller and Koh fails, the rejection based on this combination should be withdrawn.

Claims 64-79, 82, and 94-98 depend from independent claim 63, and therefore, are allowable for the reasons discussed above with respect to the

independent claim, as well as for their own recited features which are not shown or taught by the art of record.

Claim 83 stands rejected as being anticipated by Mihara. Claim 83 also stands rejected as being unpatentable over the combination of Schuele in view of Ramakrishnan. Regarding the anticipation rejection based on Mihara, claim 83 recites a high K dielectric layer comprises a portion of amorphous material and a portion of crystalline material. To allegedly teach such limitation, the Examiner refers to col. 11, Ins. 8-18 of Mihara (pg. 20 of paper no. 35) which only teaches the material for a ferroelectric layer 20 may have degrees of crystallization, that is, not completely crystalline. Mihara is completely devoid of any teaching to an amorphous material. Respectfully, the Examiner can not assume that the portion of the ferroelectric layer 20 that is not crystalline is amorphous without specific teachings to such assumption. Mihara fails to provide this teaching. Accordingly, it is inconceivable that Mihara teaches or suggests a high K dielectric layer comprises a portion of **amorphous material** as positively recited in claim 83. Claim 83 is allowable over Mihara and this rejection should be withdrawn.

Regarding the obviousness rejection based on Schuele in view of Ramakrishnan, claim 83 recites a high K dielectric layer comprises a portion of amorphous material and a portion of crystalline material. The Examiner correctly states that Schuele fails to teach crystalline material and fails to teach

amorphous material, and therefore, relies on Ramakrishnan to supply the deficiency in teachings (pg. 21 of paper no. 35). However, to modify the Schuele device, the Examiner relies on Ramakrishnan which teaches to provide a thin amorphous layer 18 as an effective diffusion barrier layer to obviate the inclusion of foreign materials in the high K dielectric layer 16 (col. 3, Ins. 15-22; col. 2, Ins. 35-60 of Ramakrishnan) (pg. 21 of paper no. 35). That is, Ramakrishnan teaches to provide a barrier layer for a capacitor (col. 3, Ins. 15-22; col. 2, Ins. 35-60). However, Schuele already provides extensive teachings to a barrier layer in a capacitor (col. 3, Ins. 1-15; Ins. 40-60; col. 4, Ins. 54-67; col. 5, Ins. 40-55; *Abstract; Background*). The Examiner is suggesting modifying the Schuele device based on teachings already included in the Schuele device. One skilled in the art with the understanding the Schuele teachings would not look to Ramakrishnan for the same redundant teachings. Remember, "[p]referably the Examiner's explanation should be such that it provides that impetus necessary to cause one skilled in the art to combine the teachings of the references to make the proposed modification." *Ex Parte Levengood*, 28 USPQ2d, 1300, 1301, Footnote 2, (Bd. Pat. App. and Inter. 1993) (citations omitted). Adding a barrier layer needlessly to the Schuele device would not be done, and therefore, there is no motivation to modify the Schuele device with the teachings of Ramakrishnan. Since the motivational rationale for combining Schuele and Ramakrishnan fails, the rejection based on this combination should


be withdrawn. Since no other proper rejection is presented against claim 83, claim 83 is allowable.

Claims 84-89 and 99-103 depend from independent claim 83, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

This application is now believed to be in immediate condition for allowance, and action to that end is respectfully requested. If the Examiner's next anticipated action is to be anything other than a Notice of Allowance, the undersigned respectfully requests a telephone interview prior to issuance of any such subsequent action.

Respectfully submitted,

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